Birstall Lodge, and also after descending the very steep hill from near the latter place, and on to Belgrave, near the river. There are, therefore, the beds of gravel just above the river, where the Mammalian remains were found, which are now in the Leicester Museum; the high flat ground of Thurcaston, and an extension of drift of an older date occurring on the flanks of the hills of Charnwood.

The great quantity of drift in Leicestershire was, many years ago, noticed in the *Reliquiæ Diluvianæ*, by Dr. Buckland, in which he gives the following extract from the Rev. W. D. Conybeare: "From Houghton-on-the-Hill, near Leicester, to Braunston, near Daventry, proceeding by Market Harborough and Lutterworth, the traveller passes over a continuous bed of gravel for about forty miles. Near Hinckley, great depositions of gravel, probably connected with this mass, are found, and afford pebbles, containing specimens of the organic remains of most of the Secondary strata in England. This deposition may probably be traced continuously to that of Shipston-on-Stour, most of the hillocks scattered over the Lias and Red Marl tract between Southam and Shipston being covered with this gravel." And again he says, "It would, however, not be difficult in many places, as, for instance, on the West of Market Harborough, and in the valley of Shipston-on-Stour, to form almost a complete geological series of English rocks from among these rounded fragments, which often occur in boulders of very considerable size."

This therefore shows a clear connexion between the gravels of Leicestershire and those near to Shipston-on-Stour, which latter I have studied with some attention, and have clearly traced them on to the high ground of the Cotteswold Hills, and I am firmly impressed with the opinion that Charnwood Forest was submerged at the same time as the Cotteswolds.

I hope, shortly, to work out the Leicestershire Gravels, and to illustrate them in like manner to my Memoir on the Cotteswold Drifts.

III.—On the Coal-bearing Rocks of Southern Chile.

By G. A. Lebour, F.G.S., F.R.G.S.,
of the Geological Survey of England and Wales;
and Wm. Mundle, M.E., member of the North of England Inst. of Min. Engin.

LITTLE as the Geology of South America has been worked, yet the presence of coal along the coast of Chile has long been known to navigators and others. Of late years this coal has been worked in sundry places—in short, wherever the circumstances seemed most favourable. The strata in which the seams occur, were made the subject of considerable study from a palæontological point of view by D'Orbigny and by Darwin; but not until the last ten or fifteen years have the resources of the country, with regard to this branch of industry, been examined into sufficiently to enable a correct estimate to be made of them. The surveys, which have been the direct result of the interest awakened by the knowledge of the presence of workable seams of lignite in Chile, have been greatly

conducive to a more perfect knowledge of the geological structure of the coast; and the consequent accumulation of material for its study has, we believe, brought it within our power, not only to add to the very limited stock of notes on the subject, but also, it is hoped, to give such explanations of some of the more obscure facts connected therewith as were, from the want of reliable data, either overlooked by earlier observers, or only vaguely suggested by them.

We may premise our remarks by saying that although the majority of the facts alluded to in this paper will be found to hold good for the whole of the Tertiary formation under consideration, they apply more strictly to the area comprised between Concepcion and Valdivia, where these rocks have been very carefully examined during a lengthened professional stay by Mr. Mundle. This portion of the coast which we have selected to illustrate the general points of our subject, contains the two most important and largest collieries of the country, namely those of Coronel and Lota, from the workings connected with which a large amount of the information in these pages has been obtained.

The Tertiary rocks (as, for want of a better term, we shall for the present call them) form a narrow strip of beds following the coast-line of Chile, and the general inclination of which is a very gentle one to the W. or N.W., that is, towards the sea. These beds rest unconformably on the older metamorphic and volcanic rocks of the country (see fig. 1), which form the bulk of the lesser chain of mountains bordering the coast, the long interior undulating plain and the great easternmost Cordillera. This is shown in fig. 1, which is a sketch section on a true scale, running from a point just S. of the mouth of the Lebu river, crossing the valley of the Bio-Bio, near Santa Fé, passing a little to the S. of Los Angeles, entering the region of the Andes proper, near Lake Canquen, and ending a few miles E. of the active volcano of Antuco.

This section is merely given to show the relative position of the larger groups of rocks, and lays claim to nothing beyond general accuracy. In order that it may the better fulfil our object, however, we have made it cut the coast at a point very near to both Coronel and Lota, to which, as we have stated above, our observations will mainly apply. At a number of other places along the coast of Chile and Patagonia, these coal-bearing rocks have been observed, from a place called Talcahuano, a few miles north of Concepcion (where the coal, says Mr. Bollaert, who surveyed the neighbourhood in 1828, "was so inferior as to be thrown aside"),[1] to some of the islands of the Chonos Archipelago, according to Darwin,[2] or even as far south as the Straits of Magellan, where coal similar in general character to that under consideration, was observed during a very hasty visit by Mr. Mundle in 1865.[3]

[1] "Observations on the Coal formation in Chile," by W. Bollaert, Esq., F.R.G.S., Journal of the R.G.S., vol. xxv., p. 172.

[2] Geological Observations on South America, by C. Darwin. London, 1846.

[3] Mr. W. Bollaert, in the paper referred to above, also mentions coal as having been found at the Straits of Magellan.

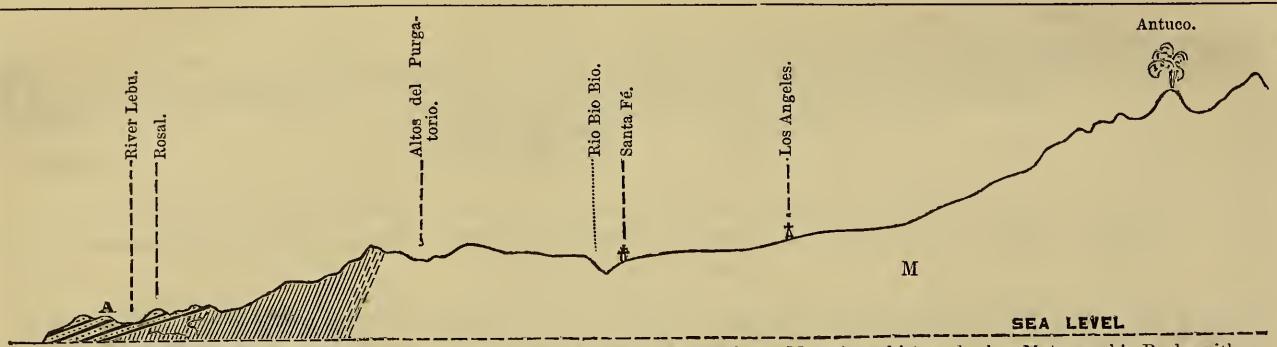

Fig. 1. Section from Pacific Ocean to Andes. A. Tertiary Coal-bearing Formation. M. Mica-schists and other Metamorphic Rocks with intrusive rocks.

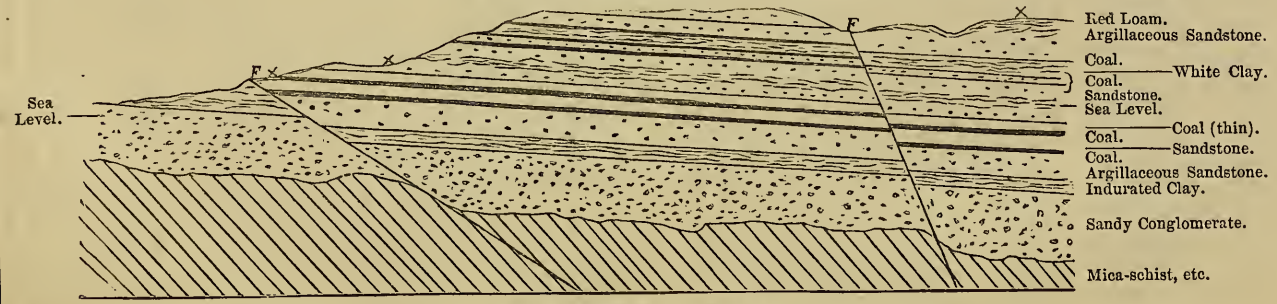

Fig. 2. Section at Coronel, Chile.

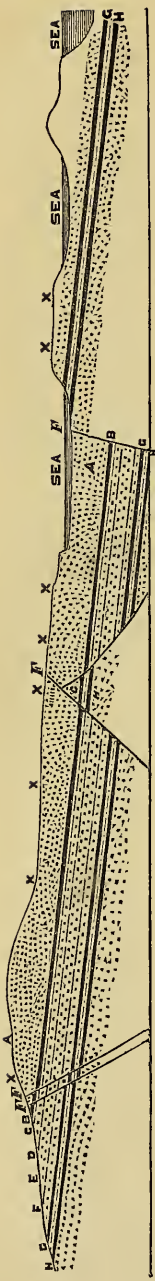

Fig. 3.—Section at the Lota Coal Mines, Chile, from Outcrop of Coal-bearing Beds to the Sea. A, Sandstone.—B_1, Top Seam.—C, Shale and Sandstone.—D, Coal with stone.—E, Sandstone.—F, Coal with stone.—G, Second Seam.—H, Third Seam.—F_1, Faults.—X denotes the position of a Pit or Bore-hole.

Scale: 240 yards to an inch.

But although beds agreeing in character, composition, and organic remains, and almost invariably lignitiferous, are thus found skirting the coast for so great a distance, they are by no means really continuous. The breaks which divide the localities from each other are often of considerable length, and, even where they are shortest, bring about a complete change in the arrangements of the deposits on either side. The probable cause of this we shall hint at farther on. At present it will be sufficient to note that the ridges of micaceous schists which separate the little coal-fields from each other, and the contour lines of which were the coast-lines during the deposition of the lignitiferous formation, are in every case distinct lines of demarcation, to the north and south of which the vertical sections, though cutting through rocks of undoubted contemporaneous age, are yet very different from each other, both in the position and thickness of their constituent beds.

This will at once be evident by glancing at the accompanying sections, the first of which is taken from a line of pits sunk in the Coronel workings, and is separated from the other (measured at Lota) by a ridge of micaceous schists, advancing from the interior into the sea; the distance between the two being only five miles, and the strata cut through by both being, without doubt, equivalent as far as geological age is concerned.

The coal-seams, it will be observed, are even less constant than the other members of the above sections.

Keeping then this arrangement of the beds in mind, we cannot be unprepared for the great dissimilarity which we find existing in the various accounts, both official and unofficial, of the capabilities of the

Chile coal-fields viewed from a commercial point of view. These vary according to the localities from which the materials of the reports have been obtained, and are very likely correct in each particular instance.

Although the object of the present paper is to describe the newer formations of Southern Chile from a purely geological, and not from an industrial point of view, yet it may be as well to give, once for all, our opinion as to the value of the coal hitherto known and worked, or which may possibly be found there. The coals won at Puchoco, Coronel, and Lota, just south of Concepcion, are universally acknowledged to be the best in the district. At Valdivia, considerably further south, the coal is also well developed, but is not so well situated for being extensively worked. Probably, still further south along the coast of Patagonia, coal may some day be profitably worked,[1] but there the amount of vegetation (to which Darwin hints the presence of lignites may be due) will long stand in the way of accurate geological surveys.

At the other places where coal has been won, it has proved little more than an inferior lignite, and even the better seams which we have named above, and a detailed account of some of which will be found in the measured section given below, can scarcely be much commended when compared even with our inferior European coals. Besides which it may be mentioned that the workable seams of Coronel and Lota are nearly worked out by this time, and will therefore be not much longer of any importance at all. In the appendix we quote from Mr. Bollaert's valuable paper, above referred to, analyses of the coals from these localities. Leaving this portion of our subject thus lightly touched upon, it will, perhaps, be best to give now a full description of the stratigraphical arrangement of the coal-bearing deposits at some particular point, which may serve as a key to the mode of occurrence of the strata, in that district at least which has been best studied. For this purpose we have chosen a section at Coronel, the perfect accuracy of which we can vouch for throughout, it having been measured bed by bed under the superintendence of Mr. Mundle. The uppermost few feet of the country consist, for the most part, of a red earthy loam, called locally Tierra Colorada, which is due to the decomposition of the volcanic rocks forming the higher parts of the interior. Below this red earth, which often attains a considerable thickness, we come to the sub-soil proper, which we will take as being the highest known member of the series. This consists, at Coronel, of—

	Ft.	In.
1. A grey argillaceous sandstone, fine-grained and micaceous . . .	45	11
2. Below this is a band of grey calcareous sandstone, also micaceous, but with small veins of Calc-spar	7	0
3. We next come to a sandstone similar to No. 1, but containing fossils (marine shells). This bed is very constant, and is, it is thought by the miners, identical with a similar one at Lota	21	6

[1] *Vide* "Informe sobre las minas de carbon del sur de Chile," by Luis Larroque, in the "Anales de la Universidad de Chile." Santiago, 1865.

		Ft.	In.
4.	Next is another band of Calcareous sandstone, very fine-grained and hard	6	0
5.	A light bluish-grey argillaceous sandstone	6	0
6.	*Coal*, hard and good, but containing Iron pyrites, and in some parts small nodules. These nodules contain many plant-remains (monocotyledons), and some reptilian-remains. This is the highest coal-seam in the district	2	6
7.	A thin band of dark-brown bituminous clay, greasy to the touch, and full of vegetable débris, filling the place of a true under-clay	0	6
8.	A soft whitish clay, which passes gradually in its lower part into a fine-grained grey argillaceous sandstone, resembling the upper beds already mentioned, but containing a small quantity of lime.	26	0
9.	We now come to the *Second Coal*. This seam is good and clean, but soft, and leaves much ash in burning	2	0
10.	A light-grey argillaceous sandstone	5	6
11.	The *Third Coal*-seam, six inches of which are taken by a band of brown micaceous shale, which divides it in the middle	2	11
12.	A fine grey arenaceous shale, in the upper part compact and hard, with a great quantity of vegetable remains, which give a streaked appearance to the rock; and at the base, a dark-brownish, indurated clay, speckled with black round spots, the centre of each of which is formed by a carbonized stem	8	0
13.	A thin band of black bituminous shale, scared with shining *Coal*. This is combustible, and after burning, is perfectly white, but it is unavailable for practical purposes	0	9
14.	A brownish indurated clay, similar to No. 12, but without spots and stems	3	7
15.	A whitish argillaceous sandstone, containing, in the upper part, many remains of ferns and trunks of trees. A thin band of shale intersects this bed, in which are numerous veins of Hæmatite and Carbonate of Lime. The sandstone gets coarser in its lower part	20	0
16.	A dark-grey shale, with carbonized remains of plants	15	10
17.	A brownish clay, micaceous, and containing in parts concretionary nodules of a pure green clay	5	3
18.	A hard grey shale, rough to the touch, with black spots in parts, and with a conchoidal fracture	4	0
19.	A white crystalline sandstone, containing (as indeed most of the grits enumerated in this section do) disseminated grains of Hornblende	5	5
20.	Alternating beds of argillaceous and calcareous sandstones, the latter being the thinner, and the former containing vegetable remains, especially in the upper parts	20	0
21.	A band of black bituminous shale	2	0
22.	The *Fourth Coal*-seam; an unimportant one, very friable, and with partings of white Dolomite and Gypsum.	0	7
23.	Black bituminous shales (in which vegetable remains become rarer towards the base), passing into a light-grey indurated clay, with carbonized plants, forming confused masses, which, with several included bands, (in most of which are impressions of leaves, etc.,) is distinctly divisible into nine different beds	14	0
24.	The *Fifth Coal*, good, hard, and clean, with pyrites in places. This is a workable seam. The floor of this coal is formed of a dark-brown bituminous slate clay, in all respects similar to the Under-clay of the First Seam (No. 6), and only a few inches thick	3	3
25.	A brownish-grey shale, very micaceous, with some impressions of leaves, and with Dolomite partings	6	6
26.	A fine-grained hard calcareous grit	0	5
27.	A spotted arenaceous shale, with scares of coal	6	4
28.	The *Sixth Coal*, divided into two seams, by one foot seven inches of grey bituminous shale, with remains of plants. The upper bed of coal is of good quality, but the lower one is earthy and bad	2	5
29.	The Under-clay to this seam is a black bituminous shale, scared with coal	1	4
30.	A blackish-grey Sandstone, streaked with whitish lines	3	9
31.	The *Seventh Coal*, good, and very clean	0	7
32.	A black bituminous shale	1	4
33.	The *Eighth Coal*-seam. This is the most important of the district, and consists of a very good, hard, and clean coal. This is, of course, the chiefly-worked seam	4	9
34.	Its Under-clay is a dark-brown bituminous shale	1	4
35.	A grey indurated clay, in parts compact and hard, in others soft and plastic	4	0
36.	A grey arenaceous shale, well stratified, very fine grained, with the grains		

		Ft.	In.
	of Quartz often replaced by grains of Hornblende, and inclosing here and there crystals of Calc-spar and small particles of crystallized Iron-pyrites	1	0
37.	A bluish-grey calcareous Sandstone, very hard and fine-grained, and much jointed, containing crystalline Dolomite in the partings	1	0
38.	A strong grey argillaceous sandstone, slightly micaceous, coarse, with disseminated crystals of Hornblende and Chlorite	75	0
39.	A brownish shale mixed with coarse particles of sand	1	3
40.	The *Ninth* and last *Coal*-seam, of fair quality	0	2
41.	Greyish and bluish shales, scared in some places by red Oxide of Iron	25	0
42.	A greenish-grey argillaceous sandstone, micaceous and fine-grained, containing many fragments of trunks of trees and ferns	2	10
43.	A light bluish-grey arenaceous shale, with scares of coal	6	6
44.	Is a rock distinctly different from any of those we have passed through in this section; this is a brownish-red argillaceous conglomerate, coarse-grained, with various sized pebbles of White Quartz, Granite, Syenite, Greenstone, Porphyry, Quartzite, etc.	3	0
45.	A much stronger thick conglomerate, more compact than the last, but with smaller sized pebbles, and consisting, in addition, of a large proportion of micaceous and Chloritic rocks	210	0
	Total	587	0

This last stratum is in direct contact with the metamorphic rocks which form the mountain range, and the dividing ridges of the Coal-district, and lies unconformably upon them. It does not enter within the scope of this paper to treat more largely of these older mica schists, chloritic schists, talcose slates, clay slates, etc. The section we have given above will, perhaps, suffice to give one a correct idea of the structural characteristics of the formation under consideration, (see Fig. 2). The next point we shall advert to, is one of more theoretical interest; namely, the mode of deposition of these beds. That they are in a great and preponderating measure of purely marine, and in the minority of cases, at least, of estuarine origin, may, we think, be safely inferred from the fossils which they contain, and that these conditions very rapidly interchanged is, likewise, easily to be seen by the thinness and variety of the beds in our section. The great and varying instability of the land during the formation of these beds, which was the evident cause of this, is little indeed to be wondered at, when we consider that a great portion of that vast upheaval to which we owe the Andes was actually going on at this very period, whether we take it to be a late Secondary one, as has been suggested, we believe, by D'Orbigny and E. Forbes, or whether, as Darwin thinks, it be one "verging on the commencement of the Tertiary era."

This alternation of the circumstances under which the deposition took place leads us, with the help of a few collateral considerations, to what we believe to be a true explanation of the dissimilarity, before referred to, between the sets of beds on either side of the ridges of older rock breaking their continuity. We are not aware that this striking discrepancy between these neighbouring sections has ever been explained, or even noticed, by any former observer. Darwin remarks, that these formations have, in some cases, "apparently been accumulated in troughs, formed by submarine ridges," in others, that "the Tertiary strata seem to have been separately accumulated in bays, now forming the mouths of valleys," but

nothing further. In order to understand our argument rightly, it will be necessary to examine briefly the conditions under which the depositions of the present day take place in the self-same regions; and as we have already taken the two localities of Coronel and Lota as types of the more ancient sedimentary accumulations, so shall we make use of them again in this instance, as typical of those at present forming. The accompanying sketch map will, it is hoped, render our meaning clearer.

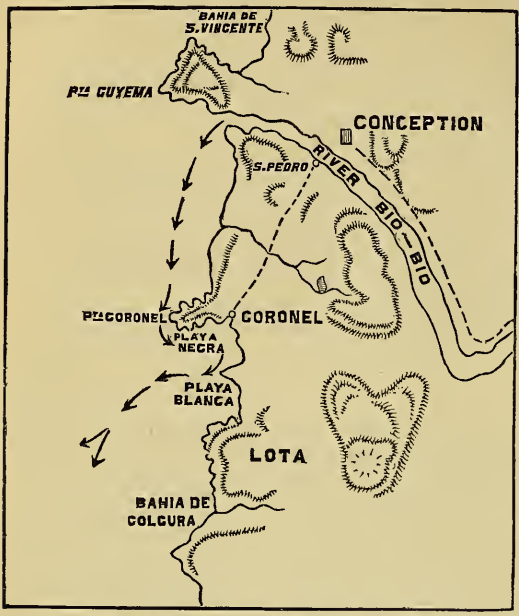

Fig. 4.—Sketch of part of the Chilian Coast.

The mouth of the Bio-Bio is, it will be seen, to the north of both Coronel and Lota. The currents along the coast have a southerly direction, and are of considerable strength. Now, the sediment held in suspension by the Bio-Bio (of which it carries vast quantities into the sea) is of a dark, almost black, colour, consisting in fact of sand derived from the black volcanic rocks through which it flows, and which are being continually worn down and transported by it, and by the many tributaries to which it owes its size. This black sand shall serve as an indicator. For observe that the shores of the two bays immediately south of the Punta Coronel have different names applied to them, viz., the northern one, that nearest the mouth of the Bio-Bio, is called Playa-negra, and the southern one Playa-blanca: that is, the black beach and the white beach. These two bays are separated by a narrow ridge of rock—mica-schist—running into the sea. The black beach receives the black sediment of the Bio-Bio, brought to it by the current which exerts its power on that river and its freight, from the moment it reaches the sea. The arrows on the map show the direction of the current. After blackening the Playa-negra, this current, which may be called the oceanic prolongation of the Bio-Bio, is diverted from its southward course by the ridge of metamorphic rock, and is driven out to sea, where it spends what is left of its cargo of black sand; and thus does it come to pass that the Playa-blanca is white, and not in any degree tainted by the black river. Here then we have two contiguous and contempo-

raneous deposits being formed of totally different materials, and containing different organic remains. The one, the black beach, made up of the débris of volcanic rocks, and containing estuarine, and possibly even fluviatile, animals and plants; and the other, a white sandy beach, composed of the débris of Tertiary sandstones, and having a purely marine littoral fauna. This, we believe, which we see at work now, was at work then, and we thus have the true key to the meaning of the want of resemblance which exists between the numerous coal-fields of the same age, which are situated all along the coast of Western South America. And, to render the analogy between the recent case and the ancient one more striking, we may remark, that the spur of rock which separates and causes the dissimilarity of the two beach-deposits is the very same one which divides the coal-field of Coronel from that of Lota. Seldom can one see so completely the little change which Time brings about in the manner in which Nature works. With regard to the geological age[1] of the Coal-bearing formation, we have little to say beyond this, that the belief of Darwin, that these beds belong either to a very old Tertiary epoch, or possibly to an era intermediate between the Secondary and the Tertiary, seems to us to be as near the truth as it is possible to arrive at, with the scanty lists of fossils at our disposal. Among these we find none that have not been enumerated before, either by Darwin or by D'Orbigny; therefore we shall limit the palæontological portion of this paper to quoting the list given by Darwin (see Appendix).

A comparison between these Coal-fields and other well-known Tertiary ones might seem, at first sight, appropriate; but the peculiarities, both of age and manner, of deposition appertaining to the beds in question, preclude the possibility of their being brought into the same category as either the German *Braun-kohl* formations, the Bovey-Tracey lacustrine deposits, or even as the Brazilian coal-bearing rocks of the river Jaguarão, which, according to Professor Agassiz, belong to the true Carboniferous period.[2]

Before concluding this paper, it is necessary to say a few words respecting the faults which dislocate the district we have been examining. Of course we are as yet only enabled to speak of those which have been observed, and proved in the carrying on of mining operations, the principal of which will be seen marked in the horizontal sections which illustrate our remarks (see Figs. 2, 3, and 5).

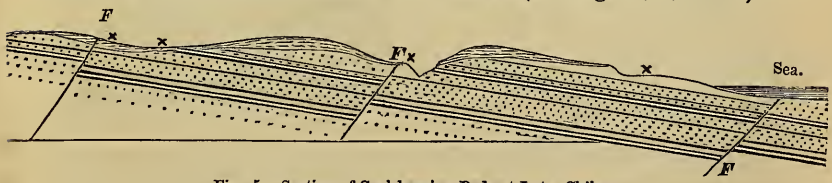

Fig. 5.—Section of Coal-bearing Beds at Lota, Chile.

[1] This I hope to consider more fully in another paper.—G.A.L.

[2] "Reports respecting Coal," Blue Book, London, 1867, p. 23. With Professor Agassiz's decision I am however disposed, with all deference, to differ.—G. A. L.

These faults run, in the great majority of cases, in a more or less N. and S. direction, that is, approximately parallel to the sea-shore, and, which is more significant, parallel also to the mountain-chains of the country. It need scarcely be pointed out that this parallelism between the lines of dislocation and the axes of elevation, is of the highest theoretical value, as showing, beyond doubt, that the elevatory action, to which the great Andian Cordillera is due, has been at work *since*, probably long since, the close of the era during which the deposition of the Chilian Coal-fields took place. This is only a confirmation of the acknowledged fact, that a very great portion of the elevation of the Andes (5,000 or 6,000 feet at least, according to Dana) was gained in Tertiary times.

From a mining and practical point of view, these faults are of value, insomuch as, by their constant upthrows of the coal-seams seawards, a considerable amount of workable coal is saved, which otherwise would be quite lost and useless. And here we may, perhaps, advert to a consequence of a want of knowledge of such faults: in Mr. W. Bollaert's paper, to which we have so often referred, the author mentions that the coal-workings at Coronel were likely to become much more extensive than those at Lota, whereas exactly the reverse has come to pass, the Lota seams being capable of being worked far under the sea, while those of Coronel have been been completely cut off by it (see Fig. 5).

With these somewhat crude remarks we conclude this paper. The analyses of coals and lists of fossils are given in the Appendix.

APPENDIX.

(*a*.) List of fossils from the coast between the Chonos Archipelago to Concepcion, form Darwin's "Geology of South America."

Turritella suturalis, G. B. Sby.
T. Chilensis, G. B. Sby.
Sigaretus subglobosus, G. B. Sby.
Cytherea (?) *sulculosa* (?), G. B. Sby.
Voluta, fragments of.
Bulla cosmophila, G. B. Sby.
Pleurotoma subæqualis, G. B. Sby.
P. araucana, D'Orbig.
Fusus cleryanus, D'Orbig.
F. subreflexus (?).
F. difficilis, D'Orbig.
Triton leucostomoides, G. B. Sby.
Venus auca, D'Orbig.
Venus, fragments of.
Tellinides (?) *oblonga*, G. B. Sby.
Natica striolata, G. B. Sby.
N. (?) *pumila*, G. B. Sby.
N. araucana, D'Orbig.
N. Australis, D'Orbig.
Scalaria Chilensis, D'Orbig.
Pyrula longirostra, D'Orbig.
Cardium auca, D'Orbig.
C. acuticostatum, D'Orbig.
Mactra cicileana, D'Orbig.
M. araucana, D'Orbig.
Area araucana, D'Orbig.
Nucula Largillierti, D'Orbig.
Dentalium majus, G. B. Sby.
Trigonia Hanetiana, D'Orbig.
Pecten, fragments of two species ?
Baculites vagina, E. Forbes.
Nautilus D'Orbignyanus, E. Forbes.
Ammonites, fragments of one specimen.

It is on the last-named fossils more especially that the Cretaceous age of the lignitiferous beds was contended for by D'Orbigny.

(*b*.) The following analyses of coals are taken from Mr. W. Bollaert's paper in the Journal of the Geographical Society, vol. xxv., p. 175.

Analyses of the lignite of Talcahuano, by Admiralty Investigation Committee:

Ash	6·92
Carbon	70·71
Hydrogen	6·44
Oxygen, Sulphur, Nitrogen	15·93
	100·00

Of Lota coal, by Dr. Playfair:

Ash	5·68
Carbon	78·30
Hydrogen	5·30
Oxygen	8·37
Sulphur	1·06
Nitrogen	1·09
	100·00

Of Lota first seam, by Mr. Abel, of Coquimbo:

Ash	2·05
Carbon	83·70
Hydrogen	1·02
Oxygen and Nitrogen	13·23
	100·00

IV.—On the Glacial and Post-Glacial Deposits in the Neighbourhood of Llandudno.[1]

By Hugh F. Hall, F.G.S.

I HAVE been led to think that a description of the drift-beds in the neighbourhood of Llandudno might be interesting to the Section, on account of the discussion which took place on Mr. Morton's paper, as to the description of pebbles contained in the "Boulder-clay."

The section I have drawn is a general section, taken from a careful examination of the beds exposed at the following places: Gogarth, West side of the Little Orme, East side Little Orme, Dyganwy, Rhos, Colwyn, and Llandulas.

The base-bed taken is the Mountain Limestone. At the Little Orme is exposed above this a bed of three to five feet in thickness of Mountain-limestone rubble, angular fragments, which may probably be accounted for by the action of frost during the earlier part of the Glacial period, breaking up the exposed rock into fragments, which in this sheltered corner have not been carried away by the ice-sheet which has produced the overlying Boulder-clay, and in its greatest exposure is about 150 feet in thickness. This bed I regard as the result of the grinding down of the subjacent strata by land-ice, which, at this period, must have covered the land down probably to the water's edge; in fact, the *true Glacial period*. The materials of which these beds are composed are invariably those which would result from the breaking up and grinding down of the rocks in the immediate neighbourhood. Thus, at Rhos, it is a very

[1] Read before Geological Section, British Association, Liverpool, 1870.